AGS and RHIC aspect for low energy operation

Mike Blaskiewcz

Outline:

AGS merging

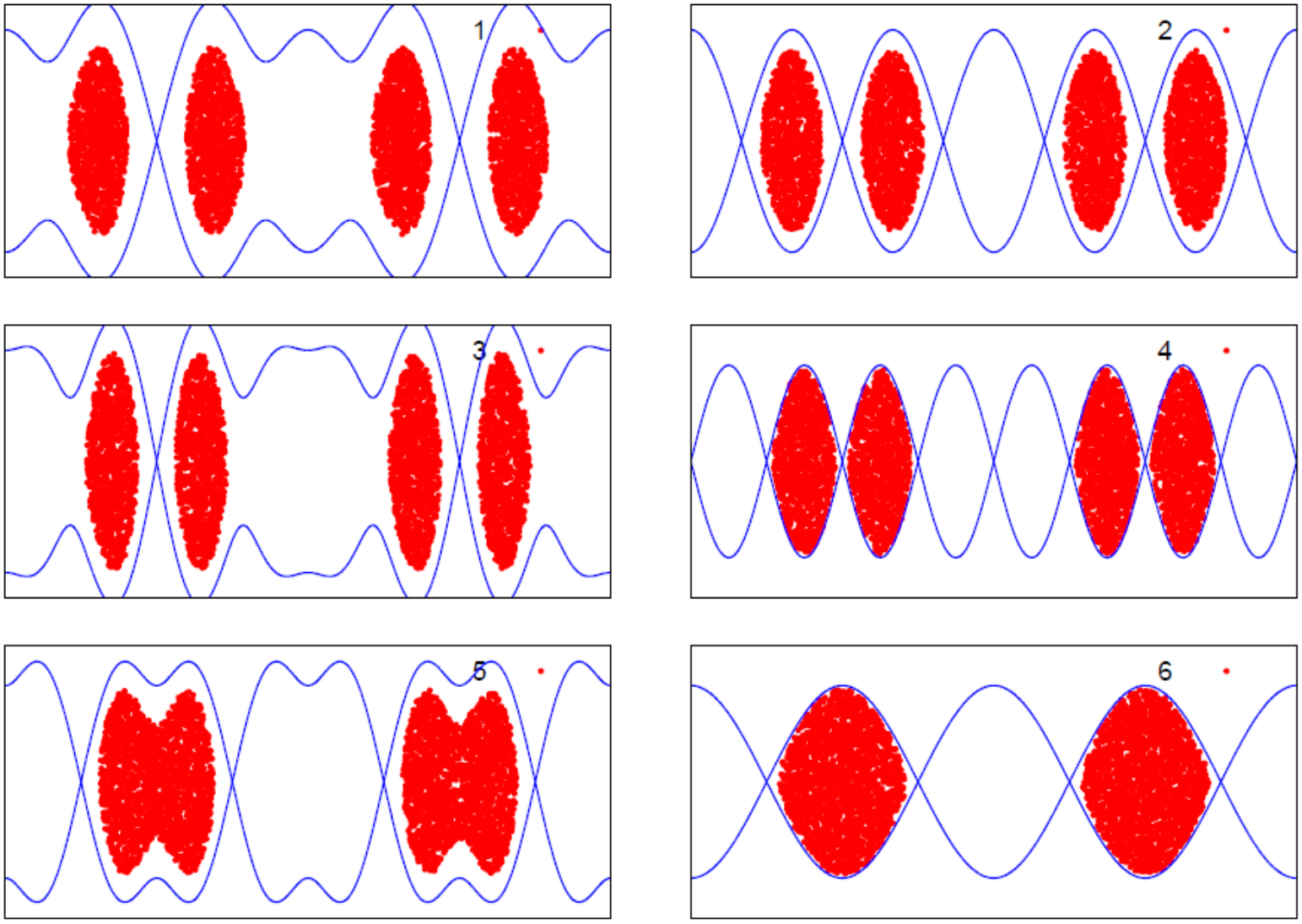
Longitudinal transfer parameters

Energy ripple in RHIC

RHIC lattice

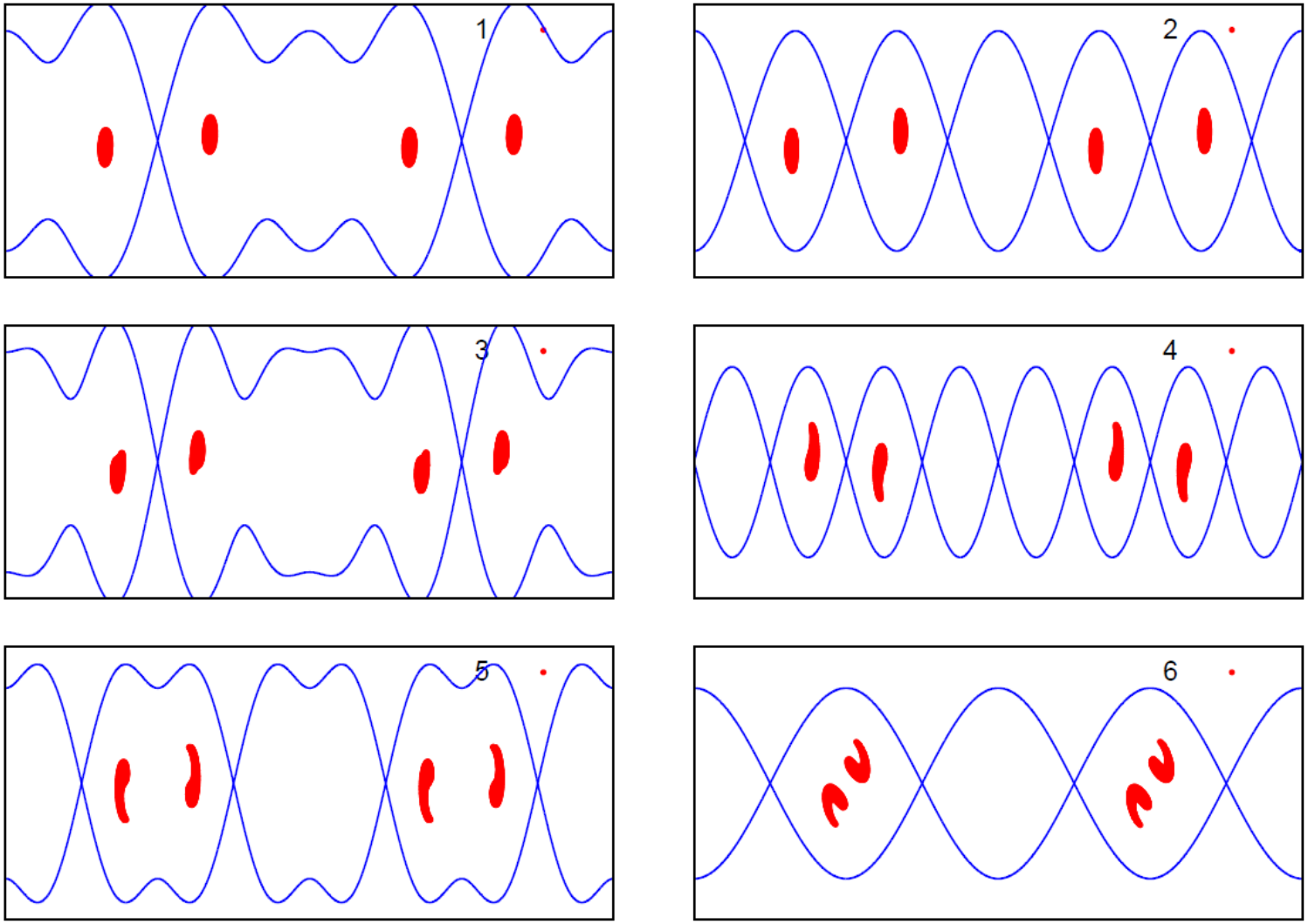
New RHIC cavities

Additional AGS merge



At injection extra merge in AGS requires at least 40kV on h=6
Final emittance is 1.1eV-s/μ, βγ=0.46. Might be better to merge at high energy

AGS merge



Merge at γ=10 requires only 20 kV on h=6, but it takes 0.7s and will require bunch by bunch damping.

Longitudinal transfer

Have 80 kV on h=60 in RHIC.

This gives a maximum momentum spread in RHIC for a given energy.

Assume the kicker allows for a 40 ns long bunch.

Find AGS voltage (h=12) corresponding to RHIC momentum spread.

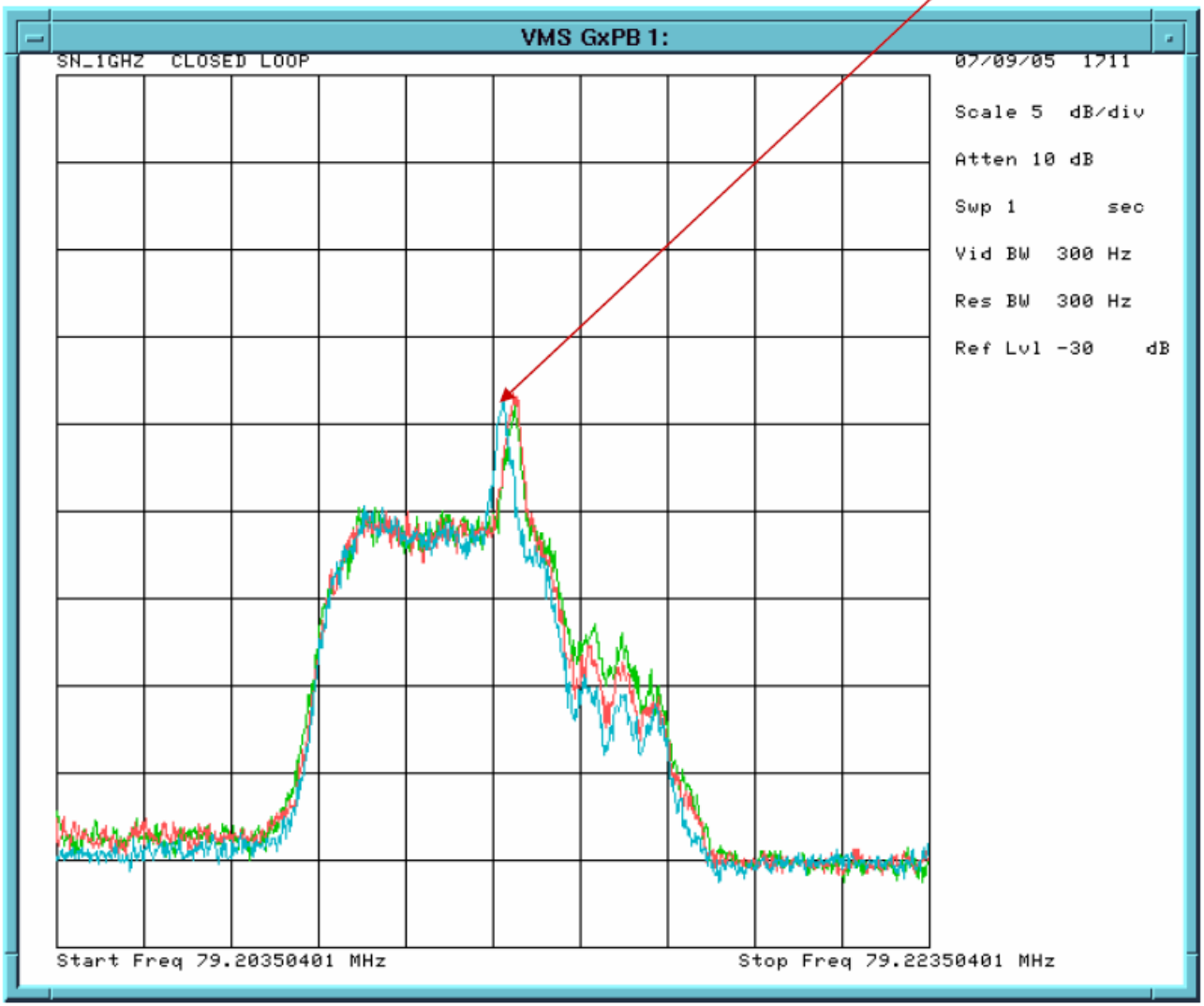
This defines the maximum emittance in AGS.

γ	Δp/p (RHIC)%	V_{max}(AGS)kV	ε eV-s/nucleon
4	0.127	180	0.27
5	0.141	150	0.39
6	0.156	120	0.53
7	0.170	75	0.66
7.5	0.177	50	0.73
9.5	0.206	60	1.1
10	0.214	90	1.1

Matching Beam Energies

- The RHIC rings are independent.
- We need the synchronous energies to agree within 2.E-4
- With coasting beam can store full width Δp/p of about 1%
- Cooling the coasting beam and looking at low frequency Schottky will allow us to correct the main magnet fields.
- Essentially what was done at FNAL recycler.

Electron energy adjusted down by 2 keV



Effect of main magnet current ripple

Need to have nearly identical beam energies in the two RHIC rings since same electron beam cools both.

Main magnet current has 25 mA ripple, γ_T=23.

$$\frac{\Delta B}{B} = \left[1 - \frac{\gamma_T^2}{\gamma^2}\right]\frac{\Delta p}{p} + \gamma_T^2 \frac{\Delta f}{f}$$

We have Δf=0 since the rings are locked.

For γ=4 the main magnet current is 190 A, Δp/p = 4.0E-6

For γ=10 the main magnet current is 500 A, Δp/p = 1.2E-5

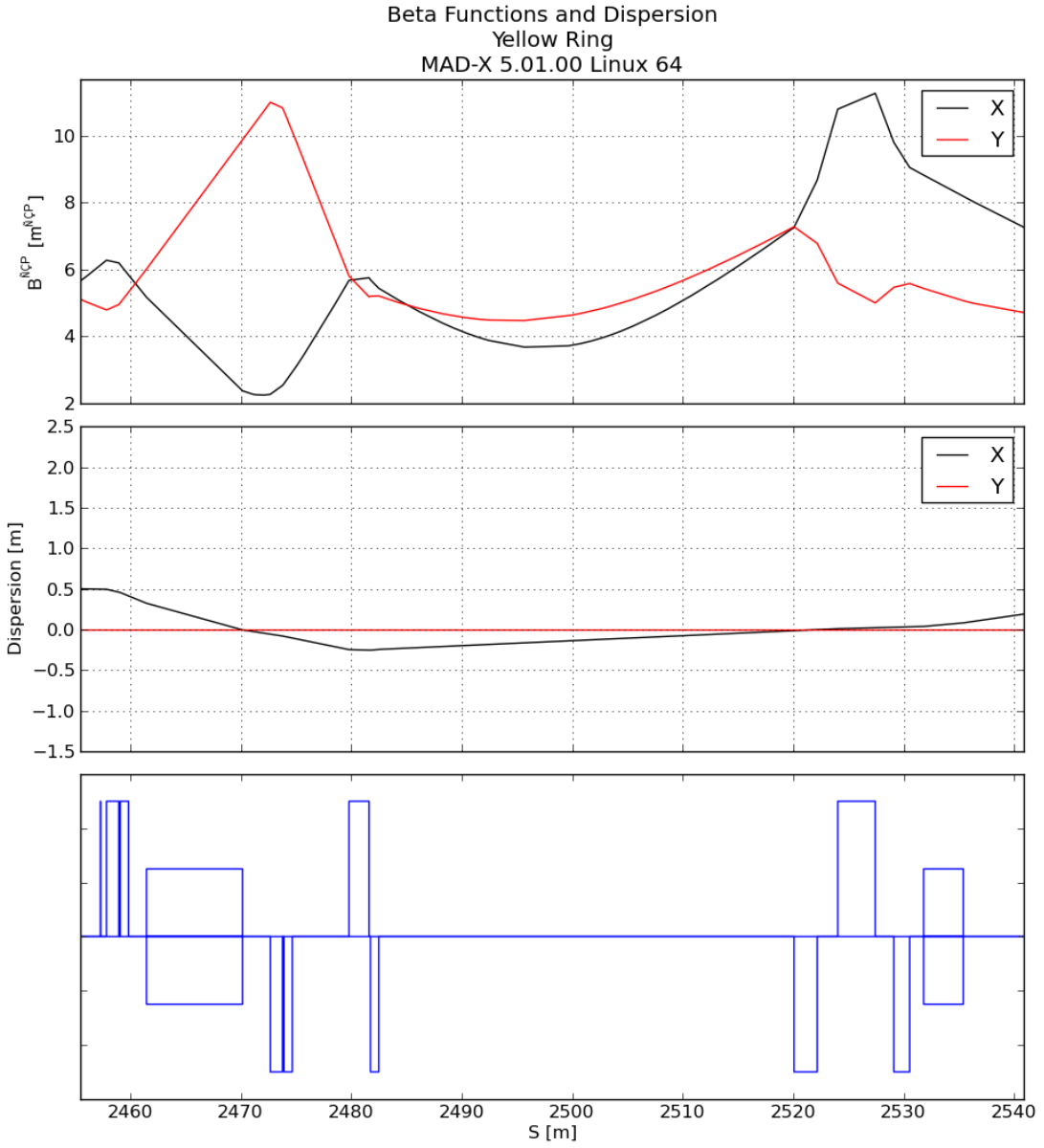
Both these values are much smaller than the momentum spread in the beam.

Optics in cooling insertion

Cooling section in the 2 o'clock IP

Yellow ring optics are shown.

Blue is similar.



4.5MHz Cavity C&F

- A concept and feasibility study has been started to propose a 4.5MHz cavity design for the new low energy gold program.

- Two design typologies are being considered for this effort.

  - *Ferrite Loaded Cavity*

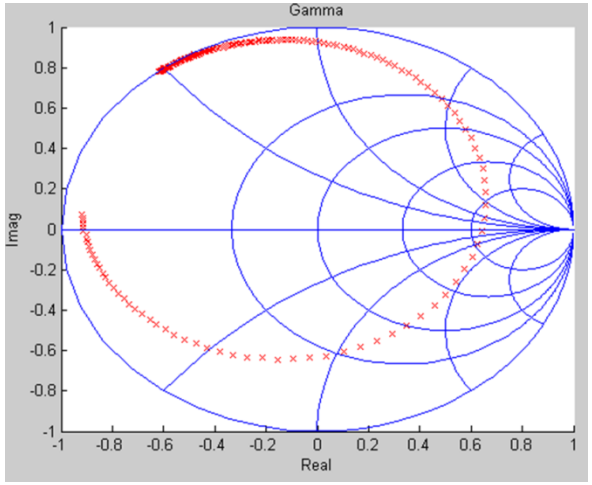
    A ferrite loaded cavity design has been fabricated and initial performance testing has been performed.

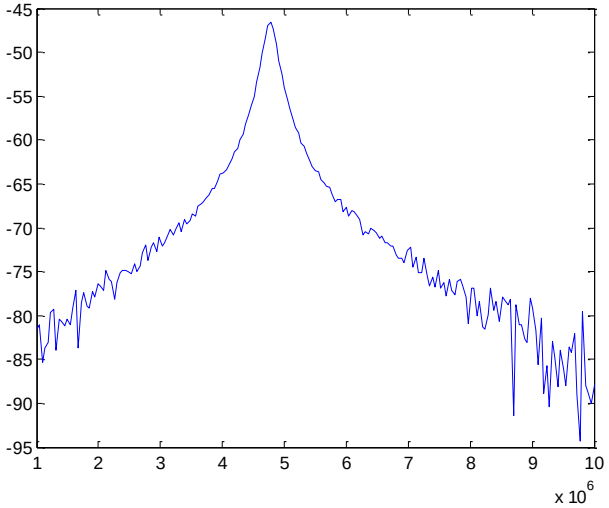
  - *Alumina Disk Reentrant Cavity*

    Preliminary simulations of an alumina disk reentrant cavity design have been completed and plans to build a scaled down version currently underway.

4.5MHz Cavity C&F

Ferrite Loaded Cavity

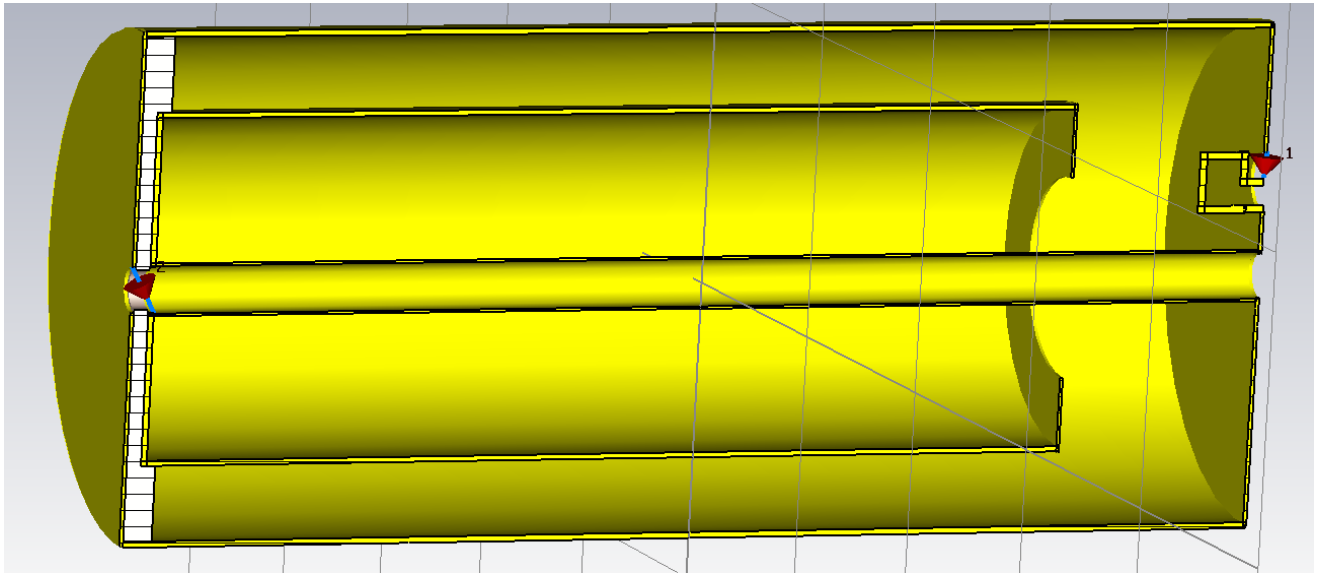




- Center Frequency = 4.7MHz
- Q = 22
- Drive Power = 2KW
- Max Voltage = 4KV (Without Bias)

4.5MHz Cavity C&F

Alumina Disk Reentrant Cavity



- Center Frequency = 4.55MHz
- Estimated Q = 4000
- Estimated Drive Power = 5KW
- Max Voltage = 40KV